THE APPLICATION OF MICROTECHNOLOGY TO SPACECRAFT ON-BOARD COMPUTING

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ABSTRACT

The recent focus and concern for smaller, less costly missions, has given further impetus for the development of microspacecraft. Microtechnology advances in the areas of sensors, propulsion systems, and instruments, make the notion of a specialized miniature spacecraft feasible in the immediate future. However, all of the spacecraft subsystems have to rely on existing on-board computing and data processing technology which is still characterized by high mass, volume, and power consumption. Moreover, the performance of current on-board computers may also pose a constraint on mission capability and scientific return.

In this report, we will survey recent advances in chip packaging and stacking techniques that allow miniature computers to be developed for space applications. Several orders of magnitude in mass, volume and power consumption are possible using these techniques. Moreover, performance improvements can be achieved by increasing the scale of multiprocessing. Most importantly, long-term survivability can potentially be improved by increasing the level of redundancy and fault tolerance.